ZOOLOGICAL SOCIETY · MANITOBA ·

ZOOLOG

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Hartmann's Mountain Zebra with off-spring born here in 1969

Books

If you are one of those who think that the world is threatened by nuclear war, you are living in a rosy coloured dream. The Rape of the Environment, prepared by the Canadian Society of Zoologists, is a statement on Pollution that outlines with some examples from each Canadian Province that a much more sinister extermination by ourselves exists. Man as a disruptive species is shown in every part of the country in all manner of endeavours. The pamphlet is not a dreamer's outpour. In cold logistics and accounting, it advises that in some circumstances the whole economy would be better off without certain enterprises. Which knocks a hole in our most beloved and most silly slogan, that for our betterment we must have growth and industry.

To get this book just write to Dr. M. J. Dunbar, Department of Biology, McGill University, Montreal, Quebec. It's free and highly recommended.

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President's Message

Harold E. Welch

Once again the white season has come to Manitoba. The last flights of ducks have gone south and our environment seems devoid of animal life. The snow strangely denies this for traced on its surface are the innumerable footprints of mammals and those few hardy birds that stay for this chilly season. With a little study one can soon identify a dozen or more tracks, and perhaps more impressively, read from the tracks some of the animal activities. Here a vole has hurried across a drift to refuge; two rabbits have gambolled; and the mark of wings has stamped out a tragic pattern of predation. Winter reveals many new secrets of Nature.

The same is true of the Zoo. For those who have not visited the Zoo in winter a special surprise is waiting. A visit on a quiet afternoon can be most revealing. I had never realized the significance of the word "snow" in the name of our Snow Leopard until last winter when I viewed this cat in the late setting sun against the snowy background of its enclosure — a magnificent sight! Our native animals, like ourselves, adapt to the cold temperature. Their pelts seem more lush, and their colours more intense. The Zebras, curiously, seem completely different in winter. Their striped pattern is more startling. Even though I know better, I begin to believe that their black and white stripes were really a modification for camouflage against snowy ground and dark tree trunks rather than for life in the veldt. The Zoo can be intriguing in winter and I invite you to visit it.

Winter also brings that troublesome problem of gifts for Christmas and New Year. May I suggest that this year you consider memberships in the Zoological Society not only for the juniors but also some of the seniors on your list.

Season's greetings.

The Costly Zoo?

Take any imaginary Zoo structure costing	$200,000.00.
Now imagine that this structure would house	40 animals.
Anybody involved in the financing of this Zoo innovation would feel entitled to scream that the cost of	$ 500.00 per head
of animal housing, appears to be high.	
Against this, hold the figure of	500,000 visitors per year.
Suddenly your investment is dwarfed to a mere	$ .40 per person
entering your Zoo in only one year's time.	
But do not forget that your imagined Zoo structure is built for a life expectancy of approximately	20 years.
You now realize that your capital investment amounts to	$ .02 per person

during the time of normal life expectancy of any solid Zoo building. Hold against this very minimal outlay the contribution of Zoo goers to the local economy. They purchase food, they purchase gas, they purchase souvenirs, they stay overnight, they speak about your county and, if they go away satisfied, attract more tourists to your area by word of mouth propaganda. What more can you ask for a $ .02 investment?

Dr. Leonard J. Goss, Director, Cleveland Zoological Gardens

Our Zoo Animal Collection (II)

Gunter Voss, Dr. rer. nat.

It has been fashionable here and there to describe animals as "hardy" or "non-hardy". These are, of course, non-scientific terms. Much depends on whether "hardiness" is talked about in Canada or in Missouri, in Russia or in southern France. Quite naturally, on account of the difference in the local climate, the number of captive animals capable of withstanding the onslaughts of winter will differ from one place to another. Hardiness has never been defined as to mean survival without artificial heat through one winter season, through a sequence of winter seasons or survival of the species. When I say survival of the species, I mean that not only one or two adult specimens survive, but the species will survive in that youngsters, regardless of whether they are born in the summer or the winter, will also survive. And not only the occasional youngster will survive, but so many youngsters that the species will perpetuate itself, not only through one generation, but through a series of generations in captivity at the same location where it has proven itself "hardy". As I said, a reliable definition of "hardiness" is not available. In most instances where the term is applied, I suspect the speaker or writer not to think of species perpetuation. He would normally think, if he thinks at all, of the survival of individual specimens, mostly adult specimens.

Now it is a very basic rule in zoology, as a matter of fact it is a basic rule in physics as well, that a body which is large has a relatively smaller surface area than a body of equal or similar shape and proportions which is smaller in body volume. In other words, young animals of one species have a relatively larger surface area, skin area, which can lose heat, than older and larger specimens of the same species. Consequently, larger adult animals could more readily withstand the onslaughts of winter and cold than younger animals of the same kind. Add to this the fact that a newly-born baby mammal arrives on earth quite wet and could in the extremes of a Canadian winter freeze to death before it has dried. The reason becomes obvious why the less thoughtful users of the term "hardiness" do not normally consider species perpetuation.

There is another consideration yet. Leaving aside for the moment the young, smaller specimens of the species in question, let us look at adult animals only. Here, as much as in human newcomers to a northern country, a physiological change seems to take place, not immediately, not in the course of the first and not in the course of the second winter, but eventually. Actually immigrants, as well as Zoo animals kept in our prairie climate of Canada show discomfort from their third or fourth winter on. Just what brings about the "change of blood" which the physiological change is popularly referred to is still not fully understood. But that there are changes of this nature cannot be questioned. Admittedly, a good many African and Indian animals have survived Canadian winters under conditions in which no artificial heat was provided. While admitting this, it must also be pointed out that a good many of them developed kidney ailments or lost their tail tips or ear tips from frost bite. The question comes immediately to mind whether a good Zoo wants to exhibit frostbitten ears and tails. There is a research station, not in Canada, but in another very cold country, where frostbites were anticipated on the tail tips of long-tailed African Monkeys which were destined to be kept out of doors at this particular research station. Anticipating the trouble, the research station director decided to have all of the monkey tails amputated in the summer. After that, he was not ashamed

of publishing on his "successful" acclimatization of African Monkeys.

Some people in northern climates consider themselves in good company when they hear or read of the famous Zoo-designer and President of a private Zoopark at Hamburg, Mr. Carl Hagenbeck. He did believe in acclimatizing selected African, South African, Australian and Indian creatures to a central European type of climate. He was careful to extend his experimentation to animals from desert and scrub regions only, regions in which nature would expose its animals to a wide range of temperatures between the hottest hours of the afternoon and the cool hours of the very early morning. Hagenbeck never attempted to expose tropical jungle dwellers to the climate of Hamburg in an unprotected environment. His sons and grandsons and the great-grandsons who now are just about to enter managerial ranks in his marvelous Zoo, traditionally kept in family possession, have improved on Carl's selective experiment. They have provided comfort to the animals. They have provided heat where artificial heat was required. They have provided windbreaks and shelters where windbreaks and shelters without heat would do the trick. They do not have one single animal with a frostbitten ear or a frostbitten tail in the fine collection of Hamburg Zoopark. To them, the comfort of the animal is more important than the so-called experiment. Our thoughts and our ideals are about identical with the thoughts and ideals of the younger Hagenbeck generations. We also want to provide comfort along with the beauty of a park-like setting. We want to provide our visitors with the pleasure of seeing healthy, unmutilated specimens and we attempt, such as the Hagenbecks and many other good Zoo folks around the globe do: to perpetuate species entrusted in our care through not only one or two generations, but through a series of many generations. Our Zoo does not have a very long tradition in this respect, but the results so far accomplished are very encouraging indeed. The ratio of animal species bearing and raising healthy young in comparison to the total number of animal species in our collection is very good indeed. It compares most favourably even with Zoos of first-class reputation. Yes, it exceeds many of their records. As our animal collection grows, we shall do our utmost to maintain this fine ratio of breeding, we shall keep in mind the requirements of the animals in our captive care, providing them not only with space, shelter and comfort, but also with holding pens, isolation dens and all the needs that arise from a breeding program designed to be successful.

Eventually when our Zoo building program has been completed to match the long range Zoo development plan, there should be no need any more for trapping animals or birds in the autumn and to transfer them into winter quarters at a different location. It is one of the principles of the master-plan to provide winter shelter right adjacent to the summer exhibit. This of course is safer, more economical, less disturbing to the animals, and therefore better all around. But at the present time we still have a very few groups of animals which require the shifting between summer exhibits and winter quarters. They are but a few groups: the smaller Wallabies belong to them, the ones we received through friendly channels out of New Zealand, some Cranes and the Waterfowl. As far as the Cranes are concerned, some of our species already have access to a Crane shelter neatly tucked away behind screen planting in the hoofstock ranges, but other Cranes still have to be transported. So then, where do the Wallabies, the Cranes and the Waterfowl go for the coldest months of the year, and can they be seen? The Zoo is in possession of two fairly large heated buildings both designed with economy and practicality foremost in mind. These efficient buildings serve their functions most excellently, but do not permit regular attendance by Zoo visitors. The buildings I am talking about are the Zebra house, smartly hidden behind the inclined stage on which

our family of Hartmann's Mountain Zebra frolic around, and the animal arrival station or nursery building, neatly hidden behind a good cover of shrubs and trees. It is the Zebra House that will accommodate most of the animals shifted, other than waterfowl. It will have a series of stalls of different size and will be heated to provide the comfort that these creatures require. The Zebra house has not been quite completed indoors yet. As long as we have to expect the contractor with his noise and disturbance, the other heated house just mentioned helps out very nicely. The nursery or animal arrival station was not primarily designed as a winter house, but was designed as just that: an animal arrival station where newcomers could be observed and, if necessary, treated and a nursery building for the hand-rearing of baby animals and birds. But, as it is an efficient and well heated fairly large building, it lends itself beautifully to relieve the pressure from the Zebra house until that one has been completed indoors.

Traditionally, the waterfowl go to the one and only large open pond available in our Zoo in the deepest of winter, in the basement of what was formerly known as the Lion House and has been converted into the commissary building. Eventually, we hope our Zoo will have an aquatic bird house so that this function of the commissary would cease. The duck room is simple, however, has served its function very well. The health of the water birds has been most excellent throughout the winter months of the last eleven years and possibly longer. We see to it that the water is changed twice daily, and with a lot of scrubbing we do overcome the accumulation of dirt that is so quickly produced by nearly one hundred birds. Altogether the accommodation has served its function well and is satisfactory, except that it does not permit viewing of the birds by the public. This of course is a sad factor since ducks look so much more attractive in their winter plumages than in the summer, when their plumages are generally drab.

As I indicated before, our winter quarters are serviceable, neat and efficient. The animals have done well in them. But our visitors cannot view them. This is a disadvantage.

Our Metro Council realized this. Shortly after having taken over the Zoo, Metro went ahead to construct our Zoo's first, publicly accessible animal house. All of you know it as the Gibbon House. There, summer and winter exhibits are linked with each other. While it is not a large animal house and lacks plant life for beautification indoors, it sets an example. Viewing is excellent. The outdoor, summer cages and habitats are considerably larger than the ones for winter. But even under winter conditions we have the use of maternity and shifting cages in the same building. All animals kept in this house have done well, and all have bred: the two species of gibbons, the two kinds of other primates, the Caucasian Porcupines and the Binturongs. We have proposed to convert the porcupine grotto into a habitat cage for porcupines and Indian Ring-necked Parrakeets, thus utilizing the upper level of the available room to better advantage. Two educational showcases are also indicative of our thoughts on zoo houses of the future.

A word of warning has to be expressed lest you consider our fine zoo as somewhat depleted of stock in the winter. Apart from our duckpond, none of the major exhibits present themselves empty. The Wallaroos and Bennett's Wallabies are still on exhibit, all the Sandhill Cranes (the world's largest captive flock) and, of course, the multitude of fur-bearing and northern mammals. At no season of the year do the Moose (three pairs) look more magnificent or the Bactrian Camels or the Arctic Foxes, Canadian Lynx and you name them. See the valuable Siberian Tiger cubs frolic with mother "Eve" right in the snow. See the impressive Mule Deer herd, the huge Manitoba Wapiti and Bison, the numerous Reindeer and the bears, and you will agree that a winter visit to Assiniboine Park Zoo can be a most rewarding experience.

Paul Geraghty, 1969

Polar Bears

Polar Bears, it is well known, have a circumpolar distribution in the Arctic regions of the earth. Not everywhere in this area, however, do they occur in equal abundance. In the Arctic of the Old World the main centers of abundance are in Spitsbergen, Franz Joseph Land, Severnaya Zemlya and on the islands off the north coast of Siberia, particularly the New Siberian Islands and Wrangel Island. In North America the main concentrations are in the Canadian Arctic Islands, Hudson's Bay and along the east coast of Greenland.

Everywhere within this vast geographic range the Polar Bear is closely associated with the sea and ice floes, and only rarely does it penetrate far inland. This dependence on the sea is aptly expressed by the species' scientific name *Ursus maritimus* and by the other generic name it is known by, *Thalassarctos* or *Thalarctos*, which is a combination of the Greek words *thalassa* (= sea) and *arktos* (= bear).

The Polar Bear's evolutionary history and its relationships to other bears are now relatively well known. Comparative studies of the skulls and teeth of present and extinct bears by European palaeontologists Erdbrink, Kurtén and Thenius indicate that Polar Bears, Brown Bears, and the now extinct Cave Bears sprang from a common ancestor. This ancestral species, *Ursus etruscus* lived in Europe during the early part of the Pleistocene, more than a million years ago. Probably during the end of the early or in the middle Pleistocene the first ancestral populations of our Polar Bear were becoming adapted to the arctic environment, possibly in the North Sea and Baltic Sea area. This long period that we call the Pleistocene was characterized by alternating periods

of glaciation, when arctic conditions extended far southward, and warmer periods when the arctic environment retreated north. It is now evident from the studies of palaeontologists that all our typical Arctic species arose from temperate zone forms during this geologically recent period. Many of these temperate zone forms or their slightly modified descendants are still with us. The fossil evidence, although meager, suggests that the Polar Bear and the Brown Bear — which includes the Eurasian Brown Bears, as well as the Alaska Brown Bear and the Grizzly — are a case in point. After having evolved in Eurasia the Polar Bear invaded North America later in the Pleistocene.

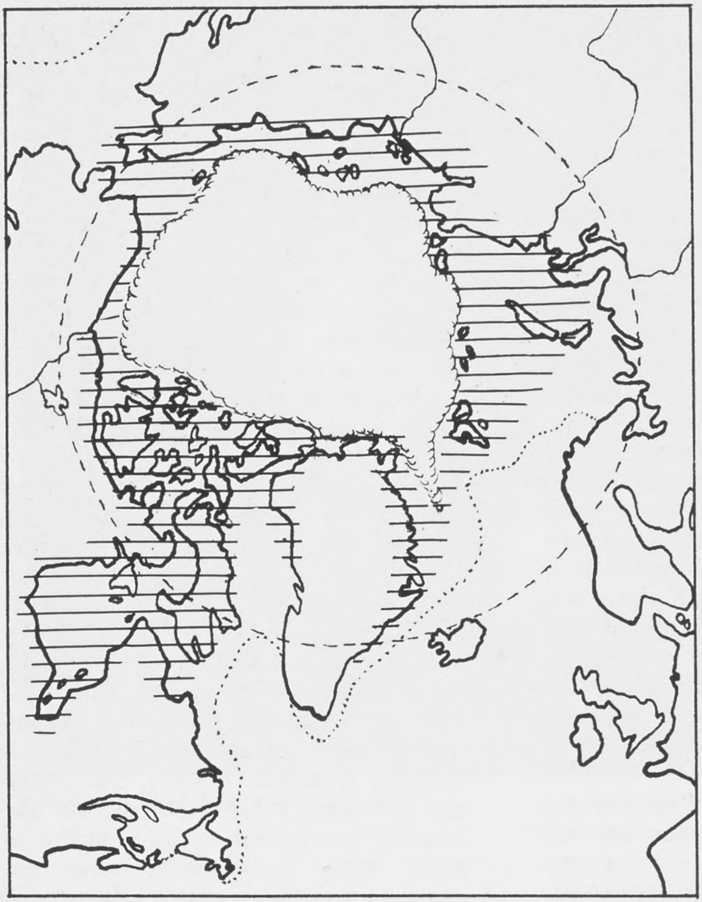
The close relationship of the Polar Bear and the Brown Bear, suggested by the fossil evidence, is further supported by comparisons of their blood sera and chromosomes, as well as by the ability of the two species to interbreed in captivity. The resulting hybrids appear to be capable of mating successfully with one another, clear evidence of the close relationship of the parental species. In view of all the evidence most mammalogists are now agreed that the Polar Bear and the Brown Bear belong to the same genus and that the latter should bear the scientific name *Ursus maritimus* rather than *Thalarctos maritimus.*

Polar Bears, of course, do differ in some ways from their nearest relatives. Most of these differences are related to the Polar Bear's way of life and the special requirements of its environment. The most obvious difference is the colour of its pelt. The white colour serves as a useful camouflage in a world which is white for the greater part of the year. It is further said to reduce heat loss. There is little doubt about the advantage of camouflage as the human seal hunter, who uses a white shield behind which to approach his quarry, well knows. As to the second alleged advantage, it is less obvious and has not yet been experimentally tested in the Polar Bear. Studies in Alaska, however, showed that white Snowshoe Hares were at no advantage in maintaining their body temperature at very low environmental temperatures compared to Snowshoe Hares that had been artificially induced to stay brown. If this can serve as an indication it probably means that protective or cryptic colouration is the significant function and not the conservation of body heat.

Naturally, fur does provide insulation and is important to the animal's conservation of body heat. However, this is true only on land when the fur is dry, immersed in the frigid sea the animal's fur loses its efficiency as an insulator. Obviously there must be other ways to prevent heat loss, besides the partial insulation provided by the fur, if the animal is to survive its often prolonged dips in the icy sea. One of these is certainly the thick layer of fat under the skin, and there are probably additional physiological mechanisms which have, however, not been studied yet in the Polar Bear. One more remark about the Polar Bear's hairy covering; it extends even over much of the animal's soles which are profusely covered with hair, that is if it has not been worn off. This hair gives the animal a good grip on slippery surfaces.

Another difference is the general shape of the head and body. In profile, the Polar Bear's head shows a "ram's nose", instead of the concave outline of the Brown Bear. Its neck is longer and its body not as short and thick set as the Brown Bear's. The skull is rather long and the molar teeth are relatively smaller, showing a reduction of those parts concerned with crushing. The cusps, however, are higher than in other bears. These tooth characters show a tendency toward adaptation to a carnivorous diet, and the Polar Bear is in fact the most carnivorous of bears.

An important factor determining the abundance and distribution of the species is of course the availability of suitable food. The Polar Bear is, as we have seen, primarily a hunter and its main prey consists of seals, in particular the Ringed Seal (*Phoca hispida*). The Ringed Seal is most abundant where we have a highly indented coastline. This type of coast is favourable for the formation of fast ice, that is ice that is



Map showing the distribution of the polar bear. The shaded area represents the geographic range of the species, the broken line is the Arctic Circle, the dotted line marks the southern limit of pack ice and the scalloped line the extent of the permanent polar pack. Occasionally individuals drift far beyond the normal limits of the species' range on ice.

securely anchored to the land. The Ringed Seals live under the ice all winter by keeping open air holes and the females give birth to their pups in dens on the ice, under snowdrifts or pressure ridges. This species is, therefore, dependent on stable ice conditions in order to raise its young successfully.

The ice serves another essential role in hunting, namely as a hunting platform. The Polar Bear cannot match the evasive skill of the seal in the water. It can only capture seals when they are on the ice, at their breathing holes or in their dens. Besides requiring seals and ice, the Polar Bear needs other things and its requirements in summer are different from those in winter. As the species cannot find all the things it needs in one place, it is of necessity rather nomadic, wandering far and wide to satisfy its specific seasonal needs.

With the coming of winter pregnant females and females with cubs look for snow banks on leeward slopes. Here they dig their dens. The cubs, usually two, are born in late November or early December. Like other bear cubs they are quite small, weighing less than 2 pounds, and are blind and deaf at birth. Only after a month or more will they be able to see and hear. In the den the

young are suckled on the mother's fat milk. Males and non-pregnant females may also den during part of the winter, but many remain active and hunt on the sea ice throughout the winter.

Mothers with cubs leave their dens in March or April to begin hunting on the sea ice. During this time the bears feed to a considerable extent on baby seals which lie helpless in their white natal coats in the snow covered dens. April is also the main mating season, but females with cubs will not mate until the next year. A female can, therefore, produce cubs every third winter during her reproductive life, which may last until her 25th year. Females mature sexually when they are 3 years old and males one year later. Mating is followed by an 8 months pregnancy, although it is suspected that actual embryonic development does not start until late September or early October, so that the real gestation period only lasts about two months. This brief period explains the relatively undeveloped state of the cubs at birth.

In summer when most of the fast ice has broken up and the pack ice has drifted or melted away, the animals may wander along the coast in search of the carcasses of seal or whale cast ashore by the sea. At this time they may also move inland to feed on berries and grass, or they may just loaf around and while away the time until winter once again comes over the land.

For millennia, Polar Bears have lived out their lives secure from predators, following only the dictates of the seasons. Then man entered the Polar Bear's world. First primitive man who, a hunter himself, not only competed with the bear for food but hunted the bear itself as well. Later western man with his more highly developed, and potentially more destructive technology, made his presence felt.

Nobody knows how many bears there were in the Arctic in primitive times. Catch records in recent years, however, indicate that the population has been declining due to exploitation by man. It is true that some of the observed changes in abundance may be due at least partially to climatic change. Whatever the exact cause, this decline led to concern in conservation quarters over the status and eventual survival of the Polar Bear, and the International Union for the Conservation of Nature (IUCN) listed the species in its Red Data Book amongst the rare and endangered animals of the world. The present world population has been variously estimated at 5,000 or 10,000 animals and the annual harvest at over a 1000 animals. Not until a better estimate of the present population becomes available, can we be sure about how critical the situation really is.

The present situation and the realization that the problem would grow more serious with the stepped up human activity and population growth in the Arctic stimulated the initiation of national programs to study the Polar Bear. This was soon followed by an international meeting in Fairbanks, Alaska in 1965, in which the five arctic nations with Polar Bears in their territories — Canada, Denmark, Norway, the U.S.A. and the U.S.S.R. — took part. At this meeting information on the problems of Polar Bear conservation were exchanged and the need for international co-operation expressed. Since then a second meeting has been held in 1968 in Switzerland, under the auspices of IUCN. Research efforts of the five nations have been co-ordinated and mutual exchange of information and assistance agreed upon. This is certainly a most encouraging development.

In Canada the Canadian Wildlife Service began a research project in 1961 under Mr. C. R. Harington, which has been continued in recent years under Dr. C. J. Jonkel. The provinces of Quebec, Ontario and Manitoba are co-operating in this project. Indeed, there is good reason to be optimistic, and one can only hope that the timely concern for this arctic species may extend itself to incorporate all aspects of the arctic environment that will come under increasing pressure in the years to come.

G. C. van Zyll de Jong

Ermine in full summer pelage

White for the Winter

As the long days of summer blend into the short cold days of winter the trees lose their leaves, many birds leave for the south and the mammals, although usually less apparently, prepare for winter in their diverse ways. Some, such as the ground squirrels, *Spermophilus*, the jumping mice, *Zapus* and *Napeozapus*, and the Woodchuck, *Marmota monax*, avoid the winter cold by retreating to their burrows and hibernating until spring. Others, the Meadow Vole, *Microtus pennsylvanicus*, and the shrews, *Sorex*, *Blarina brevicauda* and *Microsorex hoyi* for example, spend the winter under the insulating blanket of snow where the temperature reaches only a few degrees below freezing. Some mammals, however, because of their size or habits, must remain active in the cold, bright world above the snow. They grow heavy pelts, and some of the smaller of these mammals molt into a white winter "camouflage" pelage. The white coat of the weasels, for example, not only makes them less visible to potential predators such as owls but allows them to approach their prey more easily. Three of these small carnivores, the Least Weasel, *Mustela rixosa*, the Ermine, *Mustela erminea*, and the Long Tailed Weasel, *Mustela longicauda*, are common in Manitoba.

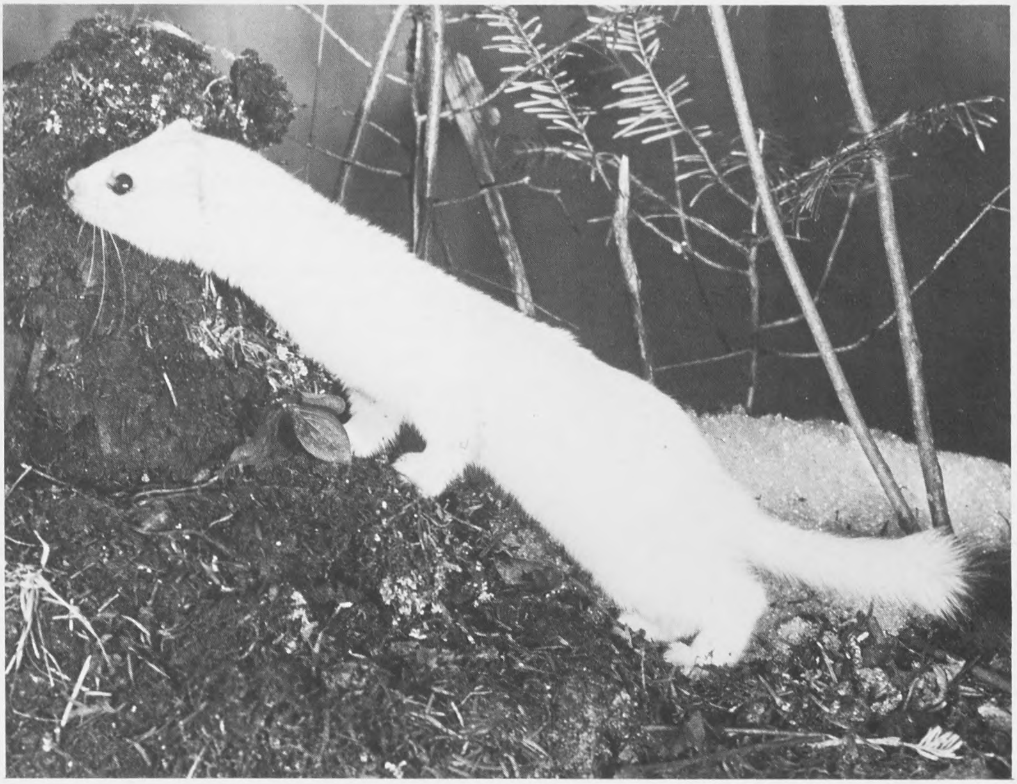
All three of these weasels travel long distances on the surface and hunt above and beneath the snow for their food. We have observed, trapped, measured, photographed and kept in captivity all three species, but the following discussion will centre mainly on the Ermine.

Ermine during molt. The dark hairs on the side and between the eyes will be the next to be lost

The Ermine lives from coast to coast in North America from Iowa and Colorado to Northern Greenland and the Arctic islands. It is a true circumpolar species in that it is distributed throughout northern Europe and the U.S.S.R. The seasonal colour change occurs in all of these areas except in the extreme southern parts of its range where some individuals fail to turn white in the winter.

The spring and fall colour changes are not due to the hair changing colour, but to a molt in which new hair grows and the old hair is shed. (See Zoolog, Volume 8, Number 4, December 1967, "Reflections on White.") The cues which induce the animal to start growing new hair are not completely understood. Animals which are moved from one area to another and kept in outside cages molt at the proper time for the area from which they were taken indicating that part of the molt controls are inherited. Blind Ermines do not molt at the correct time, nor do animals exposed to low temperatures and long hours of daylight, suggesting that light, and not temperature is important. Once the autumn molt has started, however, animals in the cold complete it more quickly than animals kept at high temperatures.

The molt starts on the sides and face of the Ermine and progresses until the animal is white except for a mask and a salt and pepper on the back. Finally these areas turn white. At room temperature in the laboratory these changes take about three weeks, but they may be completed more rapidly in the field. The latest we have captured an animal in full summer pelage was 15 October. One Ermine captured on 17 October was in the process of changing colour, and several animals captured in early



Ermine in full winter pelage. Note the tail tip which remains black all winter

October and held in the laboratory started changing between 21 and 24 October. The earliest animal caught in full winter pelage was captured on 12 November and the Ermines in the lab usually attained full winter pelage by 20 November.

This timing of colour change correlates well with the first snowfall in Pinawa area. In four of the last five years, the first permanent snow has fallen between 7 and 17 November. From the middle of October, however, there has often been snow on the ground for a few days at a time. From our evidence, it appears that the Ermine begins its colour change when temporary snow is likely and completes it a few days before snow remains on the ground for the rest of the winter.

In conclusion, the Ermine and probably weasels in general, have a very efficient mechanism for changing colour at the most advantageous time. The populations in each geographic area are selected to respond to a cue, probably length of daylight, that triggers the growth of new hair. The time they finish their molt, however, is dependent not only on when they started, which varies little from year to year, but on the temperature at the time. This temperature, although not an absolute predictor of snow, at least correlates with the length of time the snow remains on the ground. A most interesting question is how long, or how short, the molting time can be in response to conditions in a particular year. This can only be answered by field observations over a period of years.

Stuart L. Iverson
Health and Safety Branch,
Whiteshell Nuclear
RESEARCH Establishment,
Pinawa, Manitoba

See, Winter comes
to rule the varied year,
Sullen and sad.

James Thomson

Winter: the plants' most difficult time

Most of us experience most of our winter weather indirectly looking out a window, out of a vehicle, hearing weather reports.

It's also the rare wild animal that is really **in** the weather continuously, rather than being in its den or under some shelter at least part of the time. By these criteria woody plants are the most tolerant "weather men" of all, and continuously monitor the weather 24 hours a day, 365 days a year, every year of their existence. Their continued presence is mute testimony that the climatic conditions in an area are tolerable. It is usually the extreme parameter (lowest temperature, longest period without rain, etc.), which is directly responsible for killing the plant.

Drying out is one of the main potential hazards of being a land plant. Even being distasteful, spiny, or otherwise unattractive to grazing animals does not help to insure survival against lack of water in the physical environment. This condition of drought is sometimes called a xeric (zajr-ic) environment, and the plants which are especially adapted to live there are called xerophytes. Their survival may be based on being able to remain dormant while dry conditions exist and/or to accumulate and ration water. These qualities are certainly not a monopoly of plants, because many animals have the same survival abilities in inhospitable environments.

The key to non-drought conditions is really not that water seems to be present, but that what water is there is actually available to the organism. Thus, some pretty unlikely places are evidently really "deserts" because the organisms living there show xeric adaptations. For instance, a bog is a physiological desert even though a person would go up to his ears in water were he to casually walk into one. Many of the plants there show xeric features such as leathery leaves and deep-set stomata (leaf "breathing" pores), because the bog water is so acid as to be essentially unusable by the plant. Another unlikely "desert" is the ocean.

Some of the creatures there cannot drink sea water, or if they do drink, have elaborate mechanisms for extracting the salt from their blood.

This simply means that biological drought conditions are a consequence of a lack of usable water. For plants, snow and ice are not physiologically usable water.

It is true that dessication is not the only environmental adversity to a wintering plant; there is also the problem of maintaining the "pilot light" of life in the chilled aerial or subterranean cells, and to prevent rupturing of the cell membranes due to the formation of ice crystals inside them. These processes are fundamental changes of the cell chemistry wherein a readjustment is made in the proportion of water in the cell contents, while still maintaining the dynamic qualities of living protoplasm.

Here we will be more concerned with the overall results of this process rather than its causes. Although perennial herbs face over-wintering problems too, it's the shrubs and trees which show up most dramatically as resisters of the winter.

One of the most important environmental aspects is also the most obvious: the cold. As the temperature drops, the level of cell metabolism decreases, and hence the organism's activity, especially one whose body temperature is the same as the environment. This relationship has a practical application in refrigeration of food to minimize bacterial spoilage and of biological drugs to slow down self-destructive enzyme activity. The cold slows down the level of cellular activity of a tree or shrub, so that food need and waste production are practically zero.

When one considers that living cambium cells are maintained just under the bark of shrub and tree stems, it's obvious that these cells are well able to resist most of the rigors of the winter, but a bit of additional natural protection is shown to help — that of drifting snow. Not only does a snowdrift shield the bark from blowing ice flakes, and hence a "sandblasting" effect, but it also helps prevent a drying out of the next season's buds. The evidence of the sparse snowfall of the far north is shown indirectly by the low stature of the vegetation: everything protruding above the snow gets blasted or dessicated to death. The pennant trees of the high mountain peaks also show this effect, as do seaside plants, though the cause is different for each; a drying out of buds on the windward side of a mountain tree, buds killed by salt crystals for the beach tree.

However, a potential hazard of a plant being protected by a light-coloured layer of snow and sand is that the sun's reradiation from this bright surface may unnaturally heat-up nearby stems so as to cause them to resume greater metabolic activity during the warming. Then when the sun goes down, and the night-time deep cold returns, these parts are more vulnerable to cold injury and drying. During the beginning of spring this process may operate in a reverse manner. The exposed stems absorb the sun's energy and reradiate it onto the nearby snow, thus melting it fastest just around the branches and trunks.

The several different plant organs have various minimum / maximum temperatures at which they are able to perform the same function. This is the basic explanation for spring sap beginning to flow in still cold roots at approximately the same time as in the relatively warmer trunk and stems.

The vegetation around Winnipeg: the former grasslands — now largely croplands — and the aspen forest parklands are made up of plants which over the millennia have adapted their biochemistry to change with the extremes of temperature and moisture occurring on a Prairie. Few other regions on earth have such a range from the hottest to the coldest. So we, in our year round constancy of body temperatures and 75 degree room temperatures, should be aware of the flexibility of the metabolism with which native plants meet life.

F. Paul Ralston, Jr.
Curator of Botany,
Manitoba Museum of Man and Nature

H. Mossop, 1962

Hawk Owl

Winter Owl Visitations

Harold Mossop

Winter time is owl time in southern Manitoba. Of the dozen species recorded in this province, eleven have been seen here in midwinter. The Burrowing Owl is apparently the only one yet to experience a Manitoba winter.

Of special interest are winter visitations of owls from more northern latitudes. The most famous of these is that great white hunter from Arctic regions, the Snowy Owl, *Nyctea scandiaca*. Though it is doubtful if southern Canada ever experiences a winter in which this owl is entirely absent, sudden periodic increases in their numbers have been an outstanding phenomenon for many years.

These occur more or less in four year cycles and are said to coincide with seasons of food scarcity in the Arctic, notably a sudden decline in the lemming population. During the winter of 1953-4, Snowy Owls were plentiful in southern Manitoba but almost absent the next, then common again in 1957-8 when 23 were counted on our Christmas bird census. These migrations often extend far south of our borders through the Dakotas to Nebraska where some winters find them in fair numbers. They are sometimes reported in Texas.

It is difficult to credit owls (wise as they are supposed to be) with the ability to reason that food being scarce, a journey in some pre-selected direction should produce necessary sustenance. Why and how do they happen to choose the right direction?

It would seem to me that predator population in the Arctic must naturally increase with the increase of food supply. The annual migration of one of these predators, the Snowy Owl, would as a result be far more noticeable due to their increased numbers.

Another more or less regular winter visitor to southern Manitoba is that day-hunting species, the Hawk Owl, *Surnia ulula.*

As far as can be ascertained, the winter abundance of this bird has not fallen into a definite pattern. Some winters produce a fair number of reports of them and others but few. It seems certain, though, that a winter day's search through that area between Winnipeg and Kenora, Ont., would produce one or more.

As a boy I found them regular visitors to my home in St. Vital, Man., where they were attracted by my flock of pigeons. These they persistently but unsuccessfully tried to catch. Though Hawk Owls are quite speedy on the wing, pigeons are apparently able to out-manoeuvre them.

During October 1955, at Churchill, Man., Mrs. Eva Beckett reported several after an absence of many years. Later that year, in December, three of our Natural History Society members counted 5 on a trip to Pine Falls.

As small rodents form their staple diet, an abundance of wood mice or voles in an area is no doubt the key to their presence. Such was the case when the accompanying photo was taken near the Trans-Canada highway 15 miles east of the town of Richer, Man., in January 1962.

One of the most spectacular invasions of northern owls occurred during the winter of 1968-69.

For many years the status of the Great Grey Owl, *Strix nebulosa,* has been in question. Sightings of it have been sporadic and at irregular intervals; this probably due to its being an inhabitant of deep, northern forests and perhaps not necessarily because of its scarcity. At The Pas, Man., Mr. Sam Waller reported them not uncommon in 1958.

During the winter of 1922-23 and again the following winter, one to a half dozen were to be seen in a day's outing through the aspen woods south of Winnipeg. These were so tame that, unfortunately, many fell prey to .22 rifles in the hands of schoolboys during their regular Saturday rabbit hunts.

Not until 45 years later did southern Manitoba see the largest of our owls in appreciable numbers.

Reports of large, grey owls were received from motorists travelling east of Winnipeg in October and November 1968, but it was not until three staff members of our Manitoba Museum of Man and Nature, Dr. Robert Nero, Robert Taylor and Herbert Copland, travelled by car to Falcon Lake that their identity became certain. In one day in November they counted no less than 13 along the Trans-Canada highway between the town of Richer and Falcon Lake.

This many within a narrow path through just 50 miles of territory no doubt indicated many more scattered over a much wider area.

Later, during the winter, I received several more reports of grey owls in eastern Manitoba though in few cases was identity certain; Great Horned and Barred Owls are both common to that part of our province.

The Dance of the Prairie Grouse

Most rural folk of the plains and aspen parklands are familiar with the springtime courtship ritual of the Sharptail Grouse, *Pedioecetes phasianellus*, often called the Prairie Chicken or Prairie Grouse. Although the Pinnated Grouse or "Booming Prairie Chicken" was previously abundant on the great plains, modern agricultural practices have resulted in the disappearance of this species from much of its former range, and thus it is the closely related Sharptail Grouse which is the most familiar prairie grouse on the plains today. In some parts of Manitoba, Sharptails are so abundant that their dancing-grounds may be as close as one-half mile apart; and on crisp, clear spring mornings one may hear, wherever one stops to listen, the distant machine-gun rattle, bottle-pop sounds, and high pitched cries of the Prairie Grouse on their dancing-grounds.

These "dancing-grounds" vary from thirty to one hundred yards in diameter, are usually located in the open on some relatively conspicuous site, and function for the Sharptails as the only places where reproduction takes place in this species. The dancing-ground locations are often highly traditional and the grouse may return to the same dancing-ground year after year. Each male Sharptail attempts to establish a territory on his dancing-ground. These territories are irregularly shaped patches of ground, which, while they vary a great deal in size, average approximately eight yards in diameter with the smaller territories located towards the centre of the dancing-ground. One cock, usually possessing a territory near the centre of the dancing-ground, accounts for the great majority of fertilizations, and therefore fathers most of the young of that year in the area around his dancing-ground; while those cocks that do not establish territories, or that do not establish central territories, are excluded from reproducing. This highly competitive mating system has resulted in the development of an intense courtship display in this species.

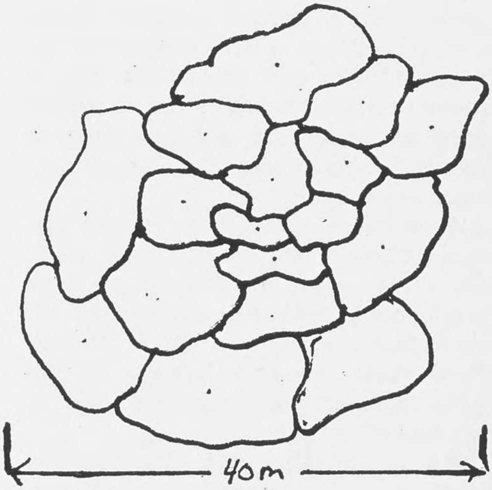


Diagram of the territorial arrangement of a medium sized dancing ground (17 birds).

The postures and sounds used by Sharptails in establishing territories and in courting hens are almost unbelievable to one who has never seen the Sharptail cock on the dancing-ground, and who thinks of him as the rather unimpressive little bird he sees in the trees, stubble, and in hunters' bags during the autumn season. The sound and sight of their display, with its incredible intensity, must really be seen to be fully appreciated. It is made even more startling when hens are present, by occasional periods of complete motionless silence; with brilliant yellow eye-combs, purple neck pouches, and vivid plumage, the cocks seem to pose together for some unseen photographer.

During the spring displays the greatest dancing-ground activity occurs just before and after sunrise (between four a.m. and six a.m.) and at temperatures which make several hours of inactivity in a blind a bit uncomfortable for the individual who wishes to observe the Sharptails on their dancing-grounds. Wet spring weather further hinders observation of the grouse, often making the best dancing-grounds difficult to reach.

Fortunately for the would-be grouse watcher spring is not the only time when the Sharptails dance. In late September or early October the cocks begin to return again each morning to the dancing-ground where they faithfully repeat the spring display, except that hens are seldom present and that actual fertilization probably never occurs. Territories are again established on the dancing-ground, and are defended there during the early morning displays until mid-November. In autumn the ground is generally drier, the scenery more beautiful, and the weather more clement than in the spring. The time of greatest dancing-ground activity is slightly later, (6:00 a.m. to 8:00 a.m.) than in the spring. These factors combine to make the period of the autumn display an excellent time to observe this fascinating phenomenon.

Sharptails have been known to return to the dancing-ground even during mid-winter, on clear mild mornings, at which times they may perform their displays on three or more feet of crusted snow. In late March, the cocks begin to return each morning to the dancing-ground despite the fact that hens don't start attending in any numbers until mid-April. During their early spring displays the cocks may dance in weather as cold as —15 degrees F.

An extremely interesting aspect of the winter or early spring display is the fact that the cocks are able to return to the exact location of their dancing-ground despite the presence of two or three feet of drifted snow which obliterates virtually all of the nearby landmarks. An even more amazing phenomenon is that at least some of the cocks are able to return to within a few feet of the position of their fall territory, and that all the cocks are able to return each day to their exact territory despite the continued changes in the topography and landmarks of the dancing-ground due to shifting winds or the melting of the snow. Birds which dance alone on one-bird dancing-grounds also show this ability. These characteristics of Sharptail were among those which I was able to document recently in a study of the behaviour and ecology of the Sharptail Grouse in Manitoba.

The ability of Sharptail cocks to locate territorial boundaries to within a foot without the use of any suitable landmarks closer than several hundred yards away is an excellent example of the powers of spatial orientation that many animals possess.

Besides being a scientifically fascinating phenomenon, the dancing-ground behaviour of Sharptail Grouse presents an equal appeal to the artistic senses, and anyone living in places such as Manitoba, where Sharptail are abundant and dancing-grounds readily located, has missed an easily achieved and unforgettable experience if he has not, at least once, witnessed the dance of the Prairie Grouse.

Bob Brown,
Dept. of Zoology,
University of Manitoba

Manitoba Rivers

Dr. R. W. Newbury,
Associate Professor,
University of Manitoba,
Civil Engineering.

PART II: **FORM**

In Part I, the annual loss of water vapour passing over the continent, equivalent to 9 inches of precipitation, was shown to be the annual discharge of rivers from the continent. The 9 inch deficit is distributed areally and correspondingly the channels that convey the deficit are ranked and distributed in a river "system".

That channels behave in a systematic manner was first postulated by William Morris Davis in 1899. His basic concept holds that the form of a river is the product of the structure and material over which the river flows, the fluvial processes of water and sediment transport, and the passage of time.

The river influences its own form by entraining and transporting material from the river basin, the wash load, and from the channel boundaries, the bed load. Where the bed material is readily transported, 3 basic river patterns have been observed to develop: straight channels, braided channels, and meandering channels. In general, straight channels occur with low discharge and high valley gradients while braided and meandering channels occur over a range of discharges under high and low gradients respectively.

A general division of channel forms based on the discharge and slope of several dozen North American rivers is shown in Figure 1. In each case, for the specific combination of discharge and slope, the most efficient means of transporting sediment is attained by the river assuming one of the 3 basic patterns.

There are rivers and reaches of a single river that are exceptions to the characteristic forms developed in erodable materials. In effect, the structure and erodability of the bed material may hinder the development of a characteristic pattern but in these cases the river may be considered to be working towards achieving the pattern.

The foregoing discussion provides a simplified framework for describing Manitoba's principal rivers. The material through which the rivers run can be geographically sub-divided into 3 principal regions: (1) the Canadian Shield region shown in Figure 2 running from the south-eastern corner of the province to the mid-point of the western boundary and covering 4/5 of the province; (2) the Lake Agassiz basin, centered on the Red River valley and Lakes Winnipeg, Manitoba, and Winnipegosis; and (3) the Second Prairie Level of Palliser, a small triangle lying beyond the Manitoba escarpment in the south-western corner of the province.

The Manitoba structure that dictates the gradients and radial pattern of rivers in the province is the most striking drainage anomaly in Canada: the Nelson-Churchill trough.

The Nelson-Churchill trough shown in Figure 2 extends from Lake Winnipeg to Hudson Bay as the topographic low point in the interior region of the Canadian Shield. In most of Canada, water falling on the Shield drains inward to Hudson Bay and outward to the Mackenzie River in the west, or to the St. Lawrence River in the south-east. However, in Manitoba, water collects on the edge of the Shield in Lake Winnipeg and spills down the trough as the Nelson River to Hudson Bay.

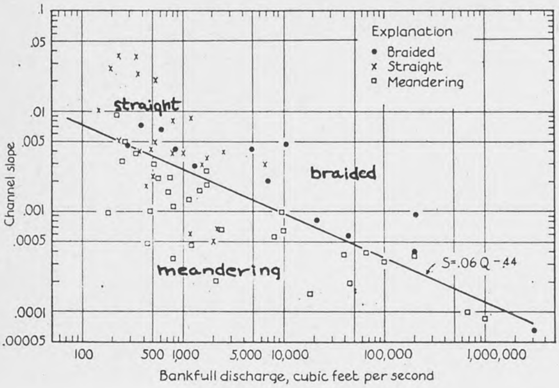


Figure 1: Characteristic River Patterns.

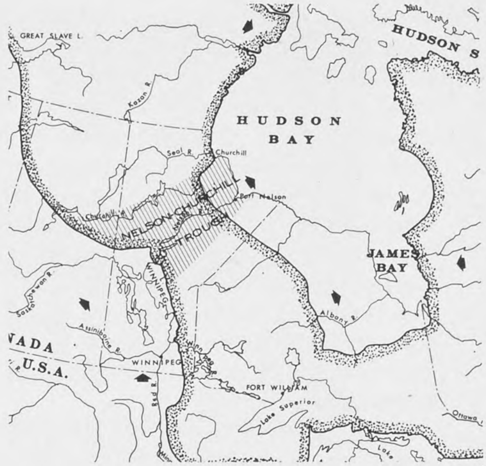


Figure 2: The Nelson-Churchill Trough.

Figure 3: Lake Agassiz Basin From Manitoba Escarpment.

River Patterns

The rivers in each of the 3 major zones in the province respond to the northern drainage anomaly in accordance with their bed materials and local gradients. **Prairie Channels:** In the south-west, the Assiniboine and Souris Rivers run through glacial till and glacio-fluvial deposits. As the material is readily erodable, the profiles of the rivers are smooth and a pattern ranging from straight to meandering has been developed. The pattern alters abruptly as the Lake Agassiz basin is approached for the slope into the basin rapidly increases. In these reaches, the rivers, including the Saskatchewan, are braiding and down cutting through their historic deltas that were formed during the recent Lake Agassiz period of de-glaciation. The Manitoba desert and Cedar Lake area are typical examples. A view of the bed of Lake Agassiz from the Manitoba escarpment is shown in Figure 3.

Lake Agassiz Basin Channels: Once the level of the Lake Agassiz basin is reached the Assiniboine River behaves much as the Red River, corresponding to the low lake-bed gradients and readily erodable lacustrine clays. The gradient and available bed load produce the meandering river form familiar to Winnipeg residents.

Canadian Shield Rivers: The largest category of rivers lie in the Pre-Cambrian Shield zone. Here the pattern is largely dictated by the highly resistant, irregular bedrock surface. Where erodable bank material overlying the bedrock is present, the rivers approach a characteristic form but in all major channels the bedrock surface appears too frequently to allow the form to persist. The banks along the mouth of the Winnipeg River shown in Figure 4 have attained some degree of meander but the river profile is dictated by the bedrock surface.

Water flowing out of Lake Winnipeg down the Nelson River is totally controlled by the irregular bedrock surface as illustrated in Figure 5 of the east channel at Norway House.

The entire 200 miles of the Upper Nelson consist of a series of abruptly connected bedrock basins and glaciated dykes while in the lower 200 miles of the river, combinations of glacial till banks and bedrock develop. The till banks allow the formation of a more uniform channel as shown in Figure 6 of the channel below Upper Limestone Rapids.

The Churchill and Hayes Rivers lie on the north and south boundaries of the trough respectively. The rivers generally possess characteristics similar to those of the Nelson but in smaller scale corresponding to their smaller discharges.

Although only major channels have been discussed in this section, tributaries may be generally characterized by the predominant materials and local gradients in each of the 3 river zones in the Province. A further parameter might be properly added to the processes of northern tributaries, that of melting perma frost with warm river flows. In this case, the displacement of material by river transport must be supplemented by gravity flows or solifluction on melting.

The hydrology and form of Manitoba rivers have been considered only under natural conditions. In the third and concluding section, the extent and effects of engineering works on Manitoba rivers will be considered.

Figure 4: Mouth of Winnipeg River.

Figure 5: Upper Nelson River East Channel at Norway House.

Figure 6: Lower Nelson River Below Upper Limestone Rapids.

Mr. Art Meers,
1148 Downing Street,
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